Department of Computer Science

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Write the C++ functions of the following problems.

Problem 1:

In this challenge, you must generate a sequence of consecutive numbers, from a lower bound that will always be equal to 1, up to a variable given higher bound (including the bounds in the sequence).

Each number of the sequence that can be exactly divided by 4 must be amplified by 10 (see notes below).

Given a higher bound num, implement a function that displays the sequence of numbers with every multiple of 4 has been amplified on the console.

Notes:

- The given parameter num will always be equal to or greater than 1.
- Remember to include the num as the higher bound of the sequence
- A number a amplified by a factor b can also be read as: a * b.
- A number a is exactly divisible by a number b when the remainder of the division a / b is equal to 0.
- Remember the function is of Void Type.

Tests Cases

- amplify(4) ⟶ 1, 2, 3, 40
  // Create a sequence from 1 to 4
  // 4 is exactly divisible by 4, so it will be 4*10 = 40

- amplify(3) ⟶ 1, 2, 3
  // Create a sequence from 1 to 3
  // There are no numbers that can be exactly divided by 4

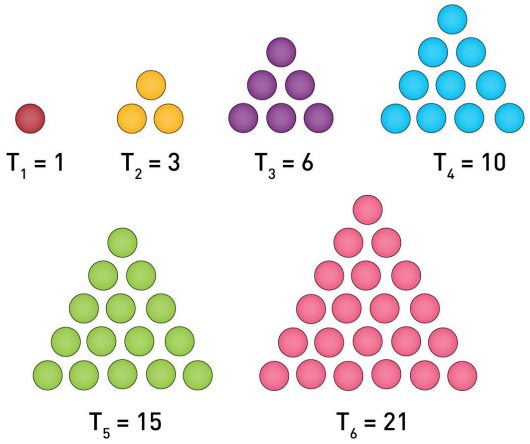
- amplify(25) ⟶ 1, 2, 3, 40, 5, 6, 7, 80, 9, 10, 11, 120, 13, 14, 15, 160, 17, 18, 19, 200, 21, 22, 23, 240, 25

// Create a sequence from 1 to 25
// The numbers exactly divisible by 4 are: 4 (4*10 = 40), 8 (8 * 10 = 80)... and so on.

Problem 2:

This Triangular Number Sequence is generated from a pattern of dots that form a triangle. The first 5 numbers of the sequence, or dots, are:

1, 3, 6, 10, 15, 21 …



This means that the first triangle has just one dot, the second one has three dots, the third one has 6 dots and so on as shown in figure.
Write a function that returns the number of dots when given its corresponding triangle number of the sequence.

Test Cases:

- triangle(1) ⟶ 1
- triangle(6) ⟶ 21
- triangle(215) ⟶ 23220

Problem 3:

For a certain period of time, patients arrive at the hospital every day for an examination. It initially has 7 doctors. Each doctor can treat only one patient per day, but sometimes there is a shortage of doctors, so the remaining patients are sent to other hospitals. Every third day the hospital makes calculations and if the count of untreated patients is greater than the count of treated ones, another doctor is appointed. Appointment takes place before the daily patient acceptance begins.

Write a program that calculates for a given period of time, the count of treated and untreated patients.

Input Data

Input is read from the console and contains:

- On the first line – the period, for which you need to make calculations. Integer in the range of [1 … 1000].
- On the next lines (equal to the count of days) – count of the patients, who arrive for treatment for the current day. Integer in the range of [0 … 10 000].

Output Data

Print on the console 2 lines:

- On the first line: "Treated patients: {count of treated patients}."
- On the second line: "Untreated patients: {count of untreated patients}."

Test Cases:

Input	**Output**	**Explanation**
4 7 27 9 1	Treated patients: 23. Untreated patients: 21.	Day 1: 7 treated and 0 untreated patients for the day Day 2: 7 treated and 20 untreated patients for the day Day 3: By this moment the treated patients are 14, and untreated ones – 20 –> New doctor is appointed. –> 8 treated and 1 untreated patients for the day Day 4: 1 treated and 0 untreated patients for the day Total: 23 treated and 21 untreated patients.
6 25 25 25 25 25 2	Treated patients: 40. Untreated patients: 87.	
3	Treated patients: 21.	

7 7 7	Untreated patients: 0.	

Problem 4:

We have n integers in the range of [1 ... 1000]. Among them, some percentage p1 are divisible without remainder by 2, percentage p2 are divisible without remainder by 3, percentage p3 are divisible without remainder by 4. Write a program that calculates and prints the p1, p2 and p3 percentages.

Example: We have n = 10 numbers: 680, 2, 600, 200, 800, 799, 199, 46, 128, 65. We get the following distribution and visualization:

Division without remainder by:	Numbers	Count	Percent
2	680, 2, 600, 200, 800, 46, 128	7	p1 = (7 / 10) * 100 = **70.00%**
3	600	1	p2 = (1 / 10) * 100 = **10.00%**
4	680, 600, 200, 800, 128	5	p3 = (5 / 10) * 100 = **50.00%**

Input Data:

On the first line of the input is the integer **n** (1 ≤ **n** ≤ 1000) – count of numbers. On each of the next **n lines** we have **one integer** in the range of [**1 … 1000**] – numbers that needs to be checked for division.

Output Data:

Print on the console 3 lines, each of them containing a percentage between 0% and 100% for example 25.00%, 66.67%, 57.14%.

- On the first line – percentage of the numbers that are divisible by 2.
- On the second line – percentage of the numbers that are divisible by 3.
- On the third line – percentage of the numbers that are divisible by 4.

Test Cases:

Input	Output
10 680 2 600 200 800 799 199 46 128 65	70.00% 10.00% 50.00%
3 3 6 9	33.33% 100.00% 0.00%
1 12	100.00% 100.00% 100.00%

Problem 5:

You are responsible for the logistics of various types of cargo. Depending on the weight of each cargo, you need a different vehicle, and this will cost a different price per ton:

- Up to 3 tons – a minibus (200 USD per ton).
- From over 3 and up to 11 tons – truck (175 USD per ton).
- Over 11 tons – train (120 USD per ton).

Your task is to calculate the average price per ton of the cargo, and also what percentage of the cargo is transported in each vehicle.

Input Data:

From the console we must read a **sequence of numbers**, each on a separate line:

- **First line**: **count of cargo** for transportation – **integer** in the range of [**1 … 1000**].
- On the next lines we pass **the tonnage of the current cargo** – **integer** in the range of [**1 … 1000**].

Output Data:

Print on the console 4 lines, as follows:

- Line #1 – the average price per ton of the cargo (rounded up to the second digit after the decimal point).
- Line #2 – percentage of the cargo, carried by minibus (between 0.00% and 100.00%, rounded up to the second digit after the decimal point).
- Line #3 – percentage of the cargo, carried by truck (between 0.00% and 100.00%).
- Line #4 – percentage of the cargo, carried by train (between 0.00% and 100.00%).

Test Cases:

Input	**Output**	**Explanation**
4 1 5 16 3	143.80 16.00% 20.00% 64.00%	By **minibus** you transport two of the cargo **1** + **3**, total of **4** tons. By **truck** you transport one of the cargo: **5** tons. By **train** you transport one of the cargo: **16** tons. **Sum** of all cargo is: 1 + 5 + 16 + 3 = **25** tons. Percentage of the cargo **by minibus**: 4/25*100 = **16.00%** Percentage of the cargo **by truck**: 5/25*100 = **20.00%** Percentage of the cargo **by train**: 16/25*100 = **64.00%** **Average price** per ton of carried cargo: (4 * 200 + 5 * 175 + 16 * 120) / 25 = **143.80**
5 2 10 20 1 7	149.38 7.50% 42.50% 50.00%	
4 53 7 56 999	120.35 0.00% 0.63% 99.37%	